

R E S E A R C H



Children with Cancer and Blood Diseases Experience Positive Physical and Psychological Effects from Massage Therapy

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Background: Previous research has shown positive effects from massage therapy (MT) for premature infants and for children with asthma, arthritis, and other illnesses. Although these effects have been demonstrated, MT research on children with cancer and blood disease is needed.

Purpose and Setting: The present study, conducted at the Cancer Center, Shands Hospital, at the University of Florida, Gainesville, measured the physical and psychological effects of MT on pediatric oncology and hematology patients. The participants were 30 children with cancer or blood disease, ages 6 months to 17 years.

Research Design: This randomized, non-blinded prospective study used measures of physical health and mental wellbeing that were completed before, during, and after four MT sessions were implemented. Descriptive statistics, one-way between-subjects analysis of variance, and an independent-samples *t*-test were used to analyze the data.

Intervention: The treatment group received 20-minute sessions of Swedish MT once daily for approximately 4 days (inpatients), or once weekly for approximately 4 weeks (outpatients); the control group received no MT.

Results: Between-groups analyses indicated significant psychological improvements for the MT group on state anxiety ($F_{1,58} = 16.79, p < 0.000$), trait anxiety ($F_{1,58} = 3.95, p < 0.000$), and emotional state ($F_{1,238} = 42.39, p < 0.001$). Between-groups analyses indicated significant physical improvements for the MT group on muscle soreness ($F_{1,238} = 38.96, p < 0.001$), discomfort ($F_{1,238} = 50.16, p < 0.001$), respiratory rate ($F_{1,237} = 22.47, p < 0.000$), and overall progress ($t_{28} = 25.55, p < 0.000$). No significant differences were found between groups on parent-completed ratings of their child's physical or psychological health, pulse rate, or blood pressure.

Conclusions: In children with cancer and blood diseases, MT can reduce psychological and physical distress and can have a positive effect on quality of life.

KEYWORDS: Massage, pediatrics, palliative therapy, oncology, hematology

INTRODUCTION

The American Cancer Society estimated 10,400 newly diagnosed pediatric cancer cases and 1545 deaths from cancer in children in 2007⁽¹⁾. Pediatric cancer patients commonly experience adverse symptoms including nausea, physical pain, anxiety, depression, weight loss, and hair loss during treatment. As providers seek affordable palliative treatment options for pediatric patients, the use of complementary and alternative modalities (CAM) such as massage therapy (MT) is becoming popular. A study in 2003 reported that 33% of parents in a primary care setting used CAM, with MT being most commonly preferred⁽²⁾. Research findings indicate that MT can improve circulation and immune function, dissolve soft adhesions, reduce swelling, and relieve the pain and stress associated with many illnesses⁽³⁻⁶⁾. These outcomes make palliative treatment with MT a viable option for children with cancer and related blood diseases such as hemophilia.

Although MT provides a promising option for children with cancer, little data focus on this population of oncology and hematology patients⁽⁵⁾. However, related research suggests that MT is an effective treatment for other pediatric populations, including premature and HIV-exposed newborns, and children with asthma, cystic fibrosis, diabetes, and rheumatoid arthritis⁽³⁻¹¹⁾. Documented outcomes include weight gain; reduced levels of stress hormone; decreased anxiety, stress, and depression; improved sleep; enhanced immune function; and reduced pain⁽³⁻¹¹⁾. Data from previous studies in various pediatric populations and settings provide supportive evidence suggesting that children with cancer and related blood diseases will receive similar benefits from MT.

Pain, a common adverse outcome associated with cancer treatment, has been defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage," coupled with "the high prevalence of painful neurological conditions"⁽¹²⁾. Several chemotherapeutic agents can cause peripheral neuropathy, a syndrome characterized by painful dysesthesia in the hands and feet, with associated sensory, motor, and autonomic deficits⁽¹²⁾. Chronic pain can lead to disability, limited activity, and psychological problems.

Increased pain perception is also correlated with higher levels of anxiety and lower self-esteem⁽¹³⁾. The relative resistance of neuropathic pain to medication justifies the use of a modality such as MT^(12,13).

A review of five non-pharmacologic strategies for managing cancer pain in adults noted that MT promotes relaxation, relieves muscle spasms, reduces pain and swelling, increases blood circulation, decreases the heart rate, and inhibits transmission of noxious stimuli by stimulating large nerve fibers that reduce pain perception⁽¹⁴⁾. When used during chemotherapy treatment in adult populations, MT has been found to reduce anxiety, nausea, and stress; to enhance sleep; and to boost the number and function of the immune system's natural killer cells^(15,16). If such improvements are replicated in future research, MT can be justified as a viable option of palliative care for pediatric cancer and blood disease patients, promoting a greater focus on healing and quality of life for these children.

The current study had three primary objectives:

- To determine the physiologic effects of MT in a pediatric oncology and hematology population
- To determine the psychological effects of MT in a pediatric oncology and hematology population
- To determine the feasibility of implementing MT as a palliative treatment option in a cancer clinic setting

The first two objectives led to the following study hypotheses:

- H_{a1} : Children with cancer and blood diseases who receive MT will experience beneficial physiologic outcomes significantly more than will equivalent children who do not receive MT.
- H_{a2} : Children with cancer and blood diseases who receive MT will experience beneficial psychological outcomes significantly more than will equivalent children who do not receive MT.

METHODS

Participants

Using convenience sampling, resident physicians chose 30 participants from a patient population in the pediatric hematology and oncology division at the Cancer Clinic and Shands Hospital at the University of Florida. Members of the control group (8 females, 7 males) and the treatment group (7 females, 8 males) were aged 6 months to 17 years (mean: treatment—10.7 years; control—9.3 years). There were 14 inpatients (8 control, 6 treatment) and 16 outpatients (7 control, 9 treatment). Table 1 gives descriptive statistics for the study participants. The diversity in age, disease, and inpatient or outpatient status was included to represent the diverse patient population in this clinical

setting and to permit an evaluation of the feasibility of implementing massage in the clinical setting while also maximizing the external validity of the study. Participants received no compensation for their participation in the study.

Design and Procedure

Potential participants were identified by physicians and subsequently approached by an investigator, at which time potential participants were informed about the study process and any possible adverse effects and benefits of the study. Consenting participants were randomized into two groups by coin toss ("heads," treatment; "tails," control) called by a witness in the presence of patient participants and their parents or guardian. Consent forms were given to each participant old enough to give consent and to the parents, parent, or guardian to read and sign. The consent of the legal guardian was obtained for all minors. Participants and parents unable to read or to understand any part of the consent form were given a verbal explanation. All participants were volunteers and were treated according to the ethical standards of the American Psychological Association code of conduct⁽¹⁷⁾.

Each participant was assigned a unique number to ensure confidentiality. Treatment and control participants were assigned to one of two schedules of four sessions each. Inpatients received daily sessions, and outpatients received weekly sessions. Sessions were conducted during regularly scheduled appointments in a treatment room or the patient's room within the clinical setting. Treatment participants received 20 minutes of Swedish MT including effleurage (gliding stroke), petrissage (kneading), percussion (tapping with fingertips, palm, fist, or side of hand), compression (constant pressure with hand or fists), and friction (deep circular or vertical motion with fingertips). The MT was provided in the spots most comfortable for the participant, most often on the hands, feet, arms, neck, back, and shoulders. To ensure participant comfort, participants were not required to disrobe for treatment. The hospital robes worn by participants made for easy access to bare hands, feet, arms, shoulders, and backs. Covers were also provided, as in standard MT practice. The therapist (JH) is a nationally certified massage therapist, licensed in the State of Florida (where study was conducted), with 5 years of experience in the field of MT.

TABLE 1 Participant Descriptive Statistics

Group	Sex (n)		Mean age (years)	Status (n)	
	Male	Female		Inpatient	Outpatient
MT	8	7	10.7	6	9
Control	7	8	9.3	8	7

MT = massage therapy.

A parent or legal guardian of the participant was present during each treatment. At each session, the massage therapist facilitated MT with the participants and thus provided a detailed demonstration for the parent or guardian, enabling parents to possibly continue implementing treatments at home; however, during the study, only the therapist provided massage to participants. Attention was given at all times to appropriate ethical procedures to ensure the safety of the participants and the continued trust and approval of the parents.

Before and after each session, the participant's vital signs (collected by BS or clinical nursing staff), discomfort level, and Faces muscle soreness and emotional data were recorded by the research assistant (BS). The research assistant (BS) collected the general clinical progress scale after the second, third, and fourth sessions. Participants or parents (or both) completed standardized measures [the State-Trait Anxiety Inventory for Children (STAIC) and the Child Health Questionnaire-Parent (CHQ-Parent)] before the first and after the final session (collected by BS).

The data collection schedules were the same for the treatment and control groups. Control participants were seen in the same environment for the same period of time for conversation and play with the therapist. If control participants were not feeling well, the therapist sat with them quietly.

Measures

Physiologic Measures

A Faces "My muscles feel ..." soreness scale with assigned values ranging from 1 ("very sore") to 5 ("very good") was used to assess muscle soreness before and after each session. The pictorial Faces self-report response scales have become increasingly popular for evaluating clinical symptoms and have been found to be valid and reliable for measuring pain-related symptoms in diverse pediatric settings⁽¹⁸⁻²⁵⁾.

Overall discomfort level was recorded before and after each session on a scale from 0 to 4 (0 being "no discomfort," 4 being "maximal discomfort"). This measure was collected as a verbal self-report, as is commonly done in clinical settings such as the one in which the present study was conducted.

Standard methods were used to assess the participants' blood pressure, respiratory rate, and pulse rate before and after each session.

The Child Health Questionnaire (CHQ)-Parent⁽²⁶⁾ has two primary scales: physical health and psychological health. It has been extensively validated in evaluations of pediatric health status internationally⁽²⁷⁻³⁰⁾. The physical health scale was used to assess general health physical function in study participants before and after the series of sessions.

Psychological Measures

The CHQ-Parent psychological health scale was used to assess general mental health in the study participants

before and after the series of sessions. The STAIC⁽³¹⁾ was used to record levels both of situational and of characteristic anxiety (minimum score: 20; maximum score: 60). The STAIC has been tested and extensively validated in diverse pediatric populations internationally^(32-36,a). Spielberger and colleagues indicate that the State-Trait Anxiety Inventory (STAI) and the STAIC have been used in 8000 studies and have been translated into 58 languages and dialects⁽³⁵⁾.

A Faces "I feel ..." affective scale was used to measure emotion, with a score ranging from 1 ("not good at all") to 5 ("very good"). As with the Faces self-report pain scale, this pictorial scale has been adapted and validated for measuring emotional symptoms in diverse pediatric settings⁽³⁷⁻⁴⁰⁾.

General Clinical Measure

A general clinical progress measure was collected at the end of the second, third, and fourth sessions to assess progress at each treatment or control session. This verbal self-report measure was rated on a scale from 0 to 10 (0 = no progress; 10 = maximal progress). Progress was defined as "feeling better overall, muscles and body feeling better, with less pain, and calmer with less tension." This measure was used as a verbal self-report, commonly collected and documented in patient records—that is, clinical SOAP (subjective data, objective data, assessment, and plan) notes.

If participants were unable to respond because of age or illness, parent reports were collected in lieu of the self-reports, consistent with common practice in clinical settings⁽⁴¹⁻⁴⁹⁾. There are constraints related to such parent-proxy reports, but Varni *et al.* suggest that although "pediatric patient self-report is advocated, there remains a fundamental role for parent proxy-report in pediatric clinical trials and health services research"⁽⁴⁹⁾.

Data Analysis

Statistical analyses were conducted to evaluate the mean differences between the treatment group and the control group. For measures collected before and after each session, including the Faces scales, discomfort scale, and vital signs, the differences between the groups were examined using a 2 (treatment) \times 4 (time) one-way between-subjects analysis of variance (ANOVA). Additionally, 2 (treatment) \times 2 (time) one-way between-subjects ANOVAs were used to compare group mean scores for the STAIC and CHQ-Parent measures taken before and after the series of sessions. *Post hoc* analyses using a Scheffe multiple comparisons test were conducted to identify

^a Kirisci L, Clark DB. Reliability and validity of the State-Trait Anxiety Inventory for children in an adolescent sample: confirmatory factor analysis and item response theory. Data presented at the Annual Meeting of the American Educational Research Association; New York, New York; April 8-12, 1996.

the source of significant differences. Because of the use of a mean composite score calculated for overall progress, an independent-samples *t*-test was used to determine any differences between the treatment and control groups in self-reported progress across the series of four sessions. Statistical significance was set at $p \leq 0.05$.

RESULTS

Physiologic Measures

Faces “My Muscles Feel ...” Scale

No significant difference was observed between treatment and control groups before treatment. However, significant mean differences on the scale of muscle

soreness were found between the groups after treatment ($F_{1,28} = 148.20, p < 0.001$), such that members of the treatment group reported significantly less post-treatment muscle soreness than did members of the control group. Scheffe comparisons indicated that the mean values of the muscle soreness scores in the treatment group increased significantly (indicating positive change) and that no significant change occurred in the control group scores. Table 2 provides pre- and post-session means and standard deviations both for the treatment group and for the control group.

Discomfort Level

We observed no significant difference in discomfort between the two groups before treatment, but significant differences between group means were indicated after treatment ($F_{1,238} = 50.16, p < 0.001$),

TABLE 2 Study Outcome Scores for the Treatment and Control Groups

Measure and Group ^a	Pre-session score [mean (SD)]	Post-session score [mean (SD)]	d ^b
Physiologic outcomes			
Faces Muscle Soreness Scale			
MT	3.06 (0.56)	4.53 (0.34)	3.03
Control	3.18 (0.65)	3.15 (0.57)	
Discomfort level			
MT	1.90 (0.50)	0.13 (0.28)	3.38
Control	1.93 (0.76)	1.92 (0.78)	
Respiratory rate (breaths/min)			
MT	21.20 (1.82)	17.93 (1.87)	1.68
Control	21.80 (3.08)	21.6 (2.50)	
Pulse (beats/min)			
MT	96.80 (17.30)	92.58 (17.73)	0.14
Control	95.02 (24.07)	95.62 (26.71)	
Systolic blood pressure (mmHg)			
MT	112.75 (12.21)	116.20 (16.32)	0.07
Control	114.55 (13.97)	117.25 (14.64)	
Diastolic blood pressure (mmHg)			
MT	63.60 (10.75)	64.07 (10.24)	−0.04
Control	62.63 (11.94)	63.57 (12.80)	
CHQ–Parent, physical health scale			
MT	25.01 (9.55)	19.08 (11.99)	0.51
Control	25.01 (11.41)	24.91 (10.98)	
Psychological outcomes			
CHQ–Parent, psychological health scale			
MT	43.80 (8.35)	46.51 (9.10)	0.30
Control	42.37 (3.76)	43.98 (7.75)	
State Anxiety Inventory for Children			
MT	33.87 (6.82)	23.00 (2.83)	2.55
Control	35.93 (8.08)	37.73 (8.73)	
Trait Anxiety Inventory for Children			
MT	32.87 (5.42)	27.73 (2.94)	1.98
Control	34.07 (5.12)	37.33 (6.77)	
Faces Emotion Scale			
MT	3.33 (0.49)	4.82 (0.42)	3.33
Control	3.35 (0.50)	3.27 (0.51)	

^a $n = 15$ for each group.

^b Values are between-groups standardized mean effect sizes; a positive value indicates a better outcome for the MT group. SD = standard deviation; MT = massage therapy; CHQ = Child Health Questionnaire.

such that the treatment group reported significantly less discomfort than did the control group. Scheffe comparisons showed that the mean values of the treated group's discomfort level scores declined significantly, but that no significant change occurred in the control group scores. Table 2 provides pre- and post-session means and standard deviations both for the treatment group and for the control group.

Vital Signs

We observed no significant difference between the groups in pulse rate ($F_{1,238} = 0.049, p < 0.825$) or in systolic ($F_{1,238} = 0.593, p < 0.442$) and diastolic blood pressure ($F_{1,238} = 0.246, p < 0.620$), before or after treatments. However, MT affected respiratory rate ($F_{1,237} = 22.47, p < 0.000$), such that, post treatment, the rate declined significantly in the treatment group as compared with the control group. Scheffe comparisons indicated that the mean values of the treated group's respiratory rate declined significantly; no significant change was observed in the scores for the control group. Table 2 provides pre- and post-session means and standard deviations both for the treatment group and for the control group.

CHQ-Parent, Physical Scale

On the CHQ-Parent questionnaire, we found no significant differences between the treatment and control groups for physical health, before or after treatments ($F_{1,58} = 1.05, p = 0.310$). Table 2 provides pre- and post-session means and standard deviations both for the treatment group and for the control group.

Psychological Measures

CHQ-Parent, Psychological Scale

On the CHQ-Parent questionnaire, we found no significant differences between the treatment and control groups for psychological health, before or after treatments ($F_{1,58} = 1.06, p = 0.308$). Table 2 provides pre- and post-session means and standard deviations both for the treatment group and for the control group.

State Anxiety Inventory for Children

We observed no group difference in the State Anxiety Inventory for Children before treatment. Post-treatment levels of state anxiety were lower in the treatment group than in the control group ($F_{1,58} = 16.79, p < 0.000$). Scheffe comparisons indicated that the mean values of the state anxiety scores in the treatment group declined significantly; no significant change occurred in the scores for the control group. Table 2 provides pre- and post-session means and standard deviations both for the treatment group and for the control group.

Trait Anxiety Inventory for Children

We observed no significant difference between the two groups in the Trait Anxiety Inventory for Children before treatments, but a significant treatment effect

was evident for the treatment group as compared with the control group after the series of sessions ($F_{1,58} = 13.95, p < 0.000$), such that the treatment group reported significantly decreased trait anxiety. The control group reports showed no significant change. Scheffe comparisons indicated that the mean values of the trait anxiety scores declined significantly in the treatment group; no significant change was observed in the scores for the control group. Table 2 provides pre- and post-session means and standard deviations both for the treatment group and for the control group.

Faces Emotion "I Feel ..." Scale

The treatment and control groups showed no significant differences in their Faces "I Feel ..." scores before treatment. However, post-treatment, the treatment and control group means showed significant differences ($F_{1,238} = 42.39, p < 0.001$), such that the treatment group reported feeling significantly better, and the control group reported no significant change. Scheffe comparisons indicated that the mean values of the emotion scores in the treatment group improved significantly. We observed no significant change in the scores for the control group. Table 2 provides pre- and post-session means and standard deviations both for the treatment group and for the control group.

General Clinical Progress Scale

We found significant differences in the mean progress scores between the treatment and control groups ($t_{28} = 25.55, p < 0.001$). The treatment group reported significant progress after the treatment series; the control group reported no change. Mean value [standard deviation (SD)] for the control group was 0.49 (0.87); for the treatment group, it was 8.62 (0.87).

DISCUSSION

Research into MT in the area of pediatric oncology and hematology is limited. The present study was conducted to examine the physiologic and psychological effects of MT on children with cancer and blood diseases. Our findings indicate a general improvement in physical and psychological well-being that supports both hypotheses posited in this study—findings that are largely consistent with those reported in related research^(4-7,14).

As seen in other cancer populations, the findings in this study are consistent with the positive rehabilitative effect of MT^(5,6,14). Physiologic measures suggest that MT reduced muscle soreness, discomfort, and respiratory rate. Psychological measures indicate that MT reduced state and trait anxiety and positively influenced overall emotional well-being, and they support prior findings that indicate that lasting psychological effects result from MT^(3,5-8). Additionally, the general clinical progress found in the treatment group suggests that MT can provide a general improvement in quality of life.

In relating measure outcomes, participants who received MT experienced a significant reduction in muscle soreness and discomfort that corresponded with slowed respiration, improvement in emotional state, and overall progress. The combination of muscle relaxation and decreased anxiety suggest that MT can induce a general sense of relaxation for recipients. Considered together, these psychophysiologic effects indicate that MT could also promote optimal immune system functioning, although the current study does not examine that effect directly. Current findings also indicate that MT can be effectively implemented within an oncology setting and can provide significant palliative benefits to pediatric recipients across a diverse age range and disease population. The results indicate that clinicians, parents, and other caregivers should consider MT a viable palliative intervention for symptom relief in children with cancer and blood disease.

It should be noted that, because parents or guardians were present for each child's treatments (which could serve as demonstrations of how MT can be provided), it is possible they may have spontaneously provided additional MT to outpatient participants in the home setting. Data concerning this possibility were not collected in the current study. We recommend that future pediatric studies collect such data from parents or guardians to account for potential confounding effects. Further, bias may have occurred in self-reports from the participants or their parents (or both) because of expectancy or social desirability effects. Finally, this pilot study did not collect data on symptoms such as nausea, headaches, and pain around access portals, although many participants reported a decrease in such symptoms. These validity threats should be addressed in subsequent studies.

Our pilot study needs to be replicated in a larger sample of patients that would allow for subgroup analysis by age, diagnosis, stage and severity of disease, and inpatient or outpatient status. A larger study might also examine the effects of MT on a diverse range of symptomology. Further, a larger study would also allow for more robust complex multivariate statistical analyses and, potentially, broader generalization of the findings.

CONCLUSIONS

The findings of this pilot study suggest that MT can be effectively implemented for pediatric oncology and hematology patients within the clinical setting to reduce adverse physical and psychological symptoms associated with cancer treatment and cancer pain. The successful recruitment and implementation in inpatient and outpatient recipients alike suggest that positive outcomes associated with MT can be achieved both for oncology and for hematology pathologies, for girls and for boys, in a wide range of age groups, in diverse clinical environments. Although cancer clinics and oncology/

hematology wards are hectic clinical settings that must provide necessarily invasive clinical care such as chemotherapy, which clearly comprises the immune system, our data suggest that the addition of MT as a palliative treatment can increase quality of life and the health of pediatric oncology and hematology patients.

CONFLICT OF INTEREST NOTIFICATION

Dr. Haun and co-authors conducted this research at the University of Florida, College of Psychology, and the Cancer Center at Shands Hospital. Research was conducted in cooperation with the Shands Hospital and the University of Florida. Dr. Haun is now at the University of Arizona College of Medicine. This publication was made possible in part by grant T32 AT001287 from the National Center for Complementary and Alternative Medicine (NCCAM). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NCCAM, the National Institutes of Health, Shands Hospital, or the University of Florida. The authors declare that there are no conflicts of interest.

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